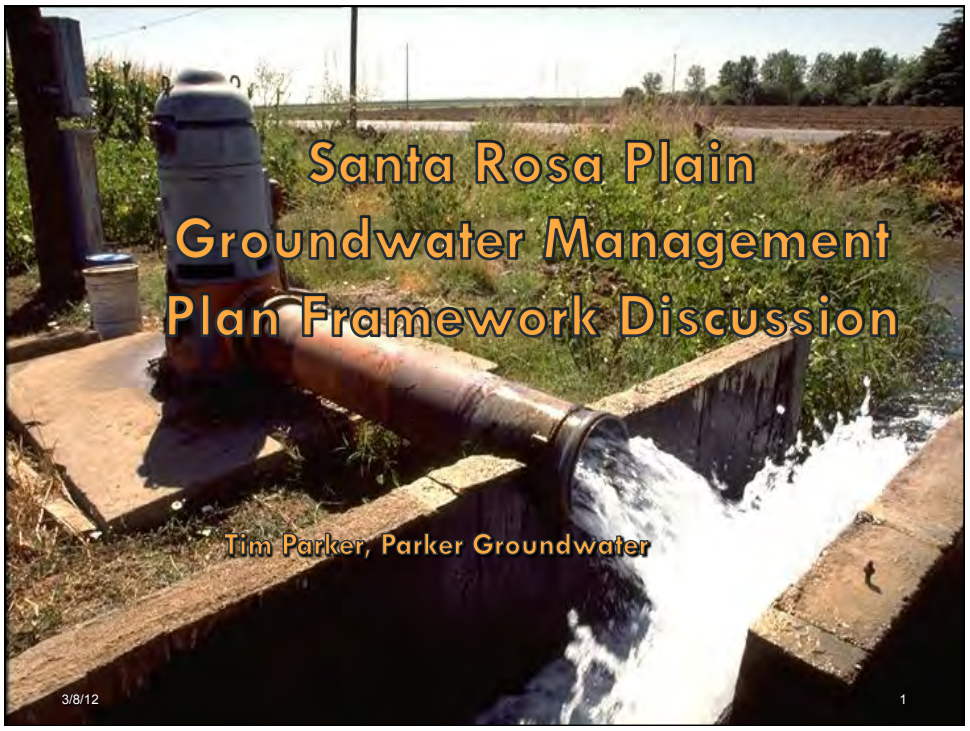

Groundwater Management

With	Without
• Maintain water quality • Stabilize groundwater levels • Meet existing and future water demands • Diversify supply	• Damaged aquifer • Poor groundwater quality • Drilling deeper wells at greater expense • Potential land subsidence • Potential legal battles or adjudication for management control

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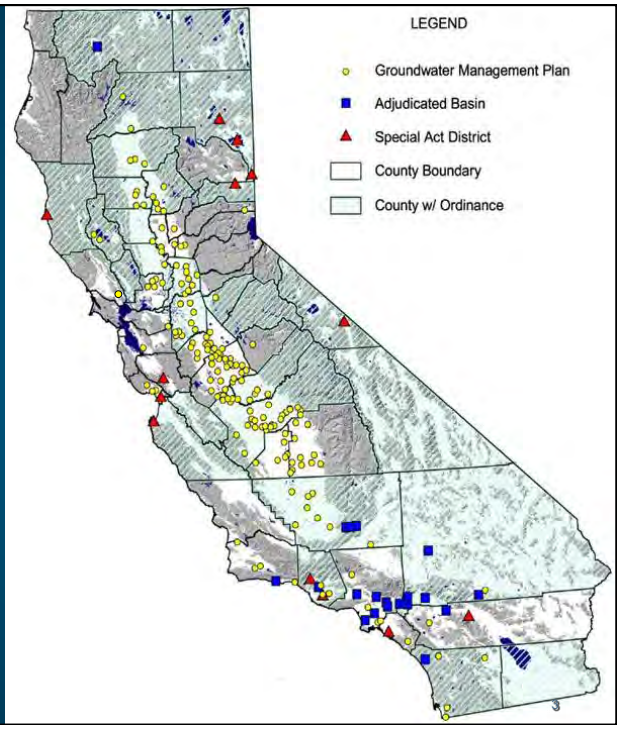
- Overlying Landowners
- Local Agencies
  - Over 1,000 agencies
  - Groundwater Management Plans
  - Special Act District
- Adjudicated Basins
- County with Ordinance



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Special Act Districts and Agencies

Requires Legislation

- Powers and organization customized for the unique political and technical characteristics of the area
- Generally empowered to conduct studies, regulate extractions, and replenish the groundwater basin
- Orange County Water District example

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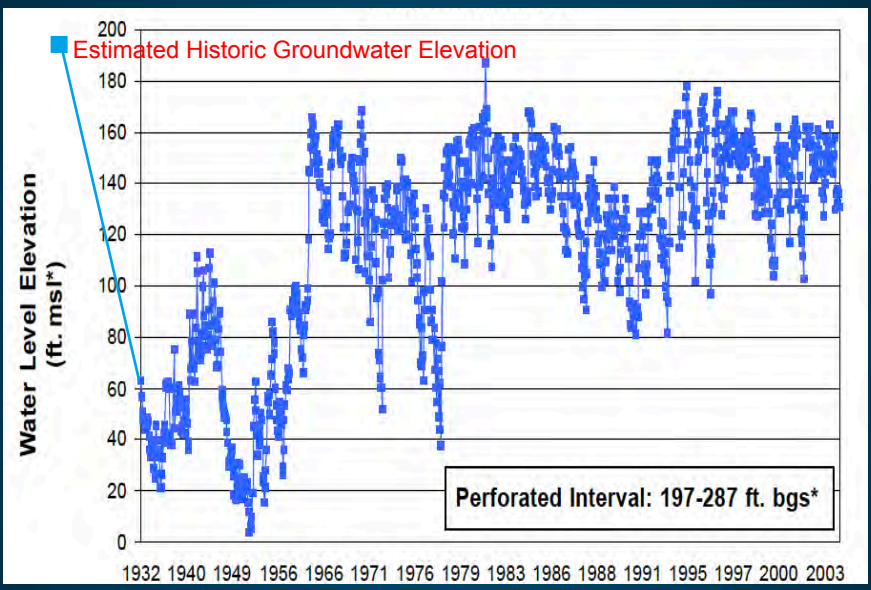

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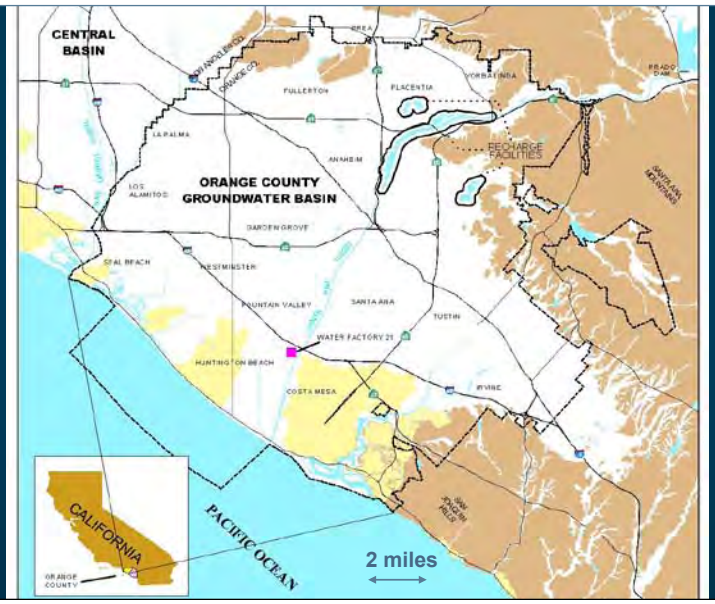
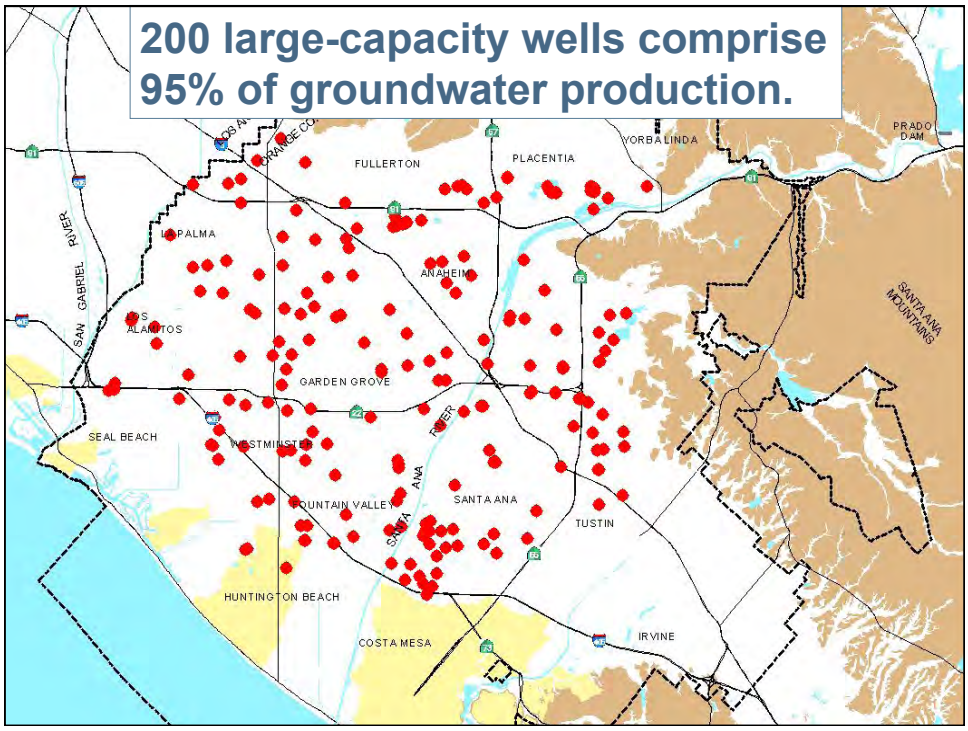
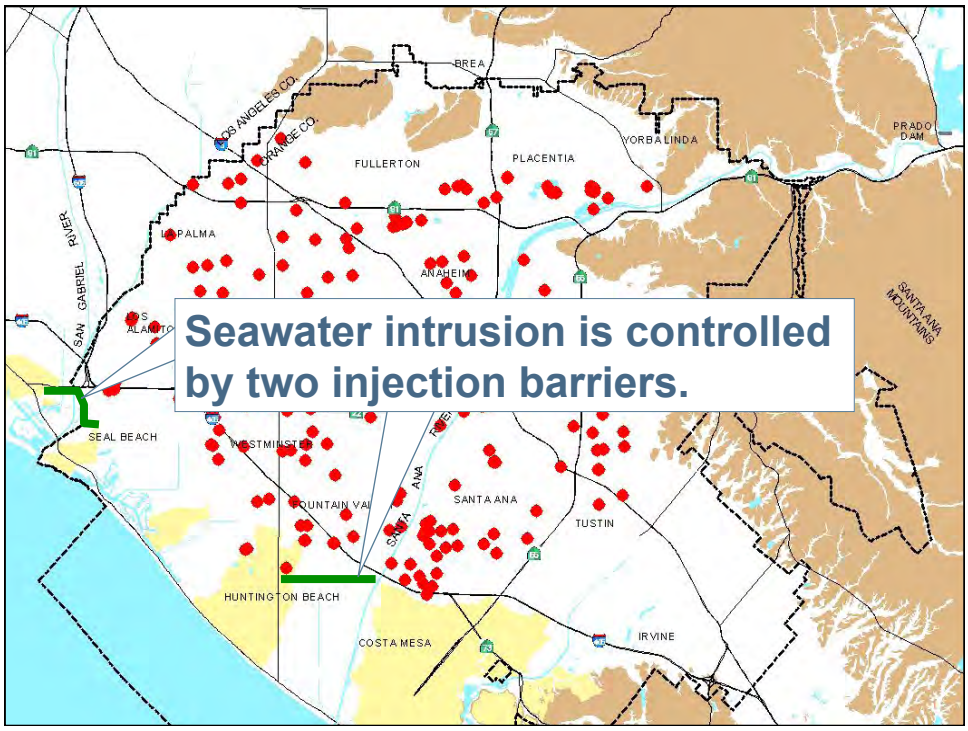
OCWD manages the 350-sq. mi. Orange County groundwater basin that supplies 330,000 af/yr (65% of demand) to 2.3 million people.




200 large-capacity wells comprise 95% of groundwater production.
FULLERTON
PLACENTIA
YORBA LINDA
PRADO DAM
LA PALMA
ANAHEIM
SAN GABRIEL RIVER
LOS ALAMITOS
GARDEN GROVE
SEAL BEACH
WESTMINSTER
SANTA ANA RIVER
FOUNTAIN VALLEY
SANTA ANA
TUSTIN
SANTA ANA MOUNTAINS
HUNTINGTON BEACH
COSTA MESA
IRVINE


Seawater intrusion is controlled by two injection barriers.
BREA
LOS ANGELES CO.
ORANGE CO.
FULLERTON
PLACENTIA
YORBA LINDA
PRADO DAM
LA PALMA
ANAHEIM
SAN GABRIEL RIVER
SEAL BEACH
WESTMINSTER
SANTA ANA RIVER
SANTA ANA
TUSTIN
SANTA ANA MOUNTAINS
HUNTINGTON BEACH
COSTA MESA
IRVINE

General Act Districts

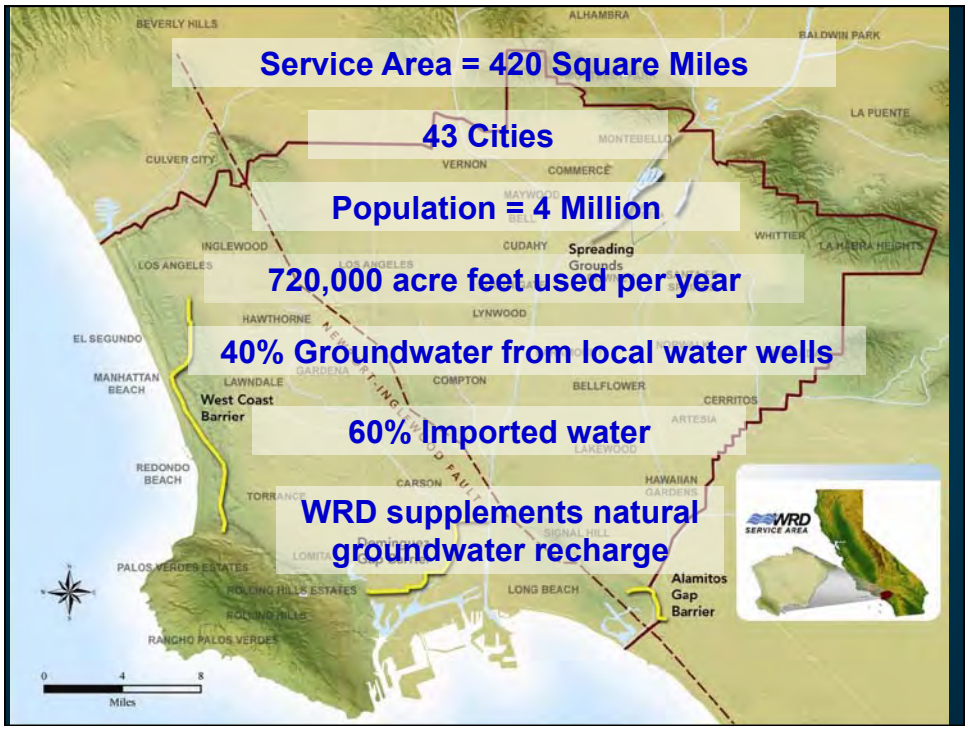
Requires Legislation

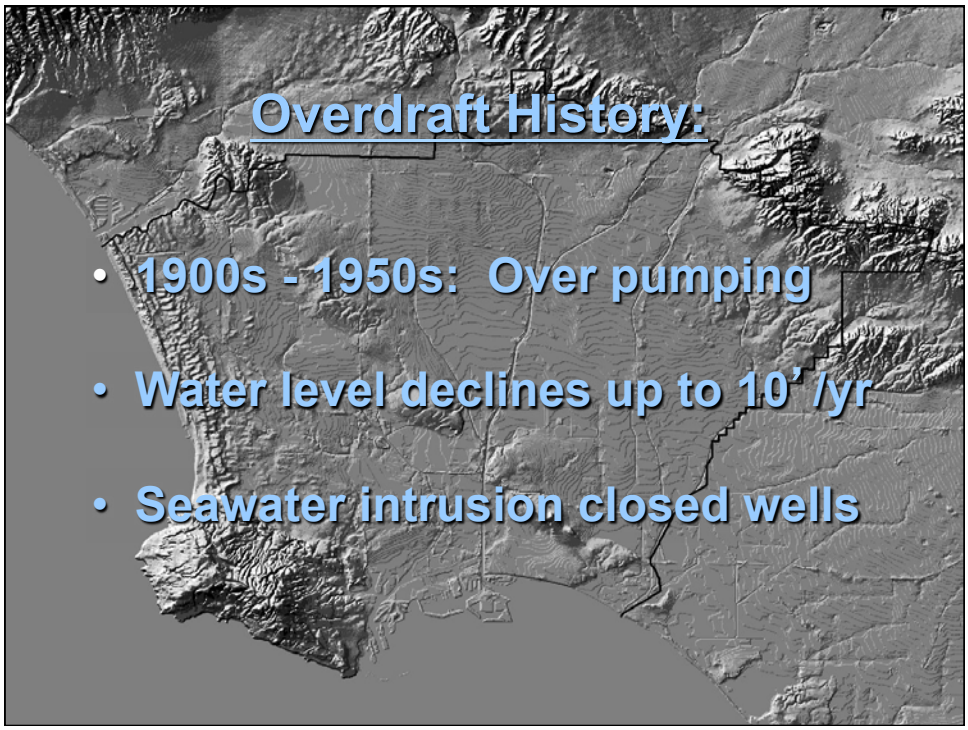
- Management indirectly accomplished through assessments and incentives
- No authority to regulate or limit groundwater extractions
- Possible limited jurisdiction over groundwater basin

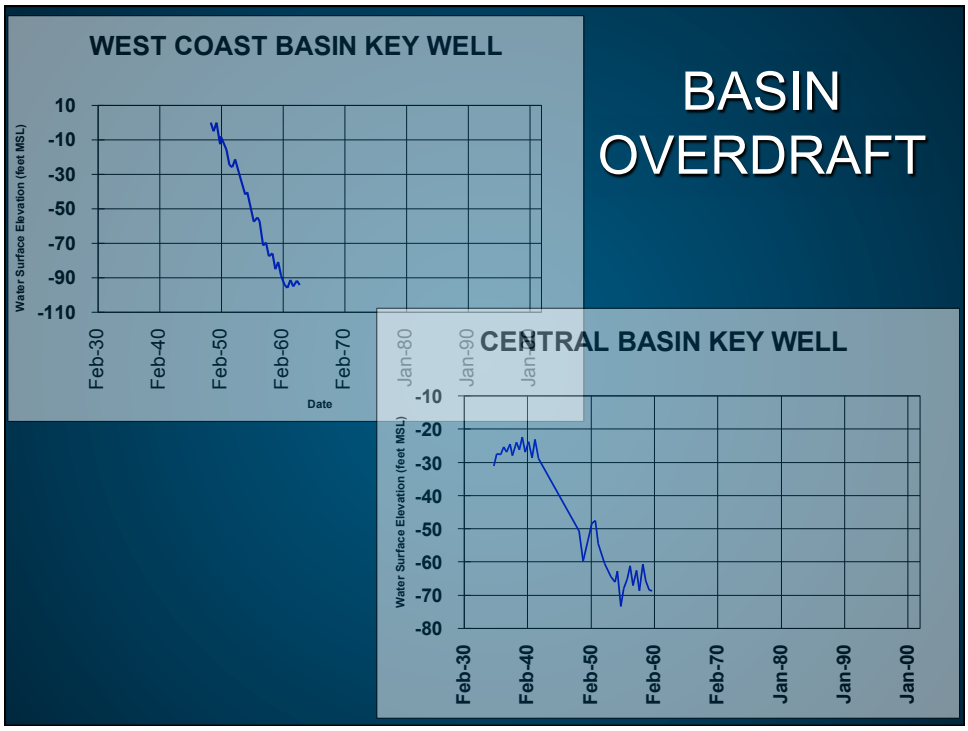
Water Replenishment District

Requires Legislation

- Can obtain supplemental supplies to directly or indirectly replenish overdrafted groundwater basins
- Also some water quality authority
- Pumpers pay WRD a fee
- One in California – Water Replenishment District of Southern California


Service Area = 420 Square Miles
43 Cities
Population = 4 Million
720,000 acre feet used per year
40% Groundwater from local water wells
60% Imported water
WRD supplements natural groundwater recharge
West Coast Barrier
Alamitos Gap Barrier
Spreading Grounds
WRD SERVICE AREA
BEVERLY HILLS
ALHAMBRA
BALDWIN PARK
LA PUENTE
CULVER CITY
VERNON
COMMERCE
MONTEBELLO
WHITTIER
INGLEWOOD
CUDAHY
LOS ANGELES
LYNWOOD
HAWTHORNE
EL SEGUNDO
MANHATTAN BEACH
LAWNDALE
GARDENA
COMPTON
BELLFLOWER
CERRITOS
ARTESIA
LAKEWOOD
REDONDO BEACH
TORRANCE
CARSON
HAWAIIAN GARDENS
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
RANCHO PALOS VERDES
LONG BEACH
0
4
8
Miles


Overdraft History:
• 1900s - 1950s: Over pumping
• Water level declines up to 10’ /yr
• Seawater intrusion closed wells

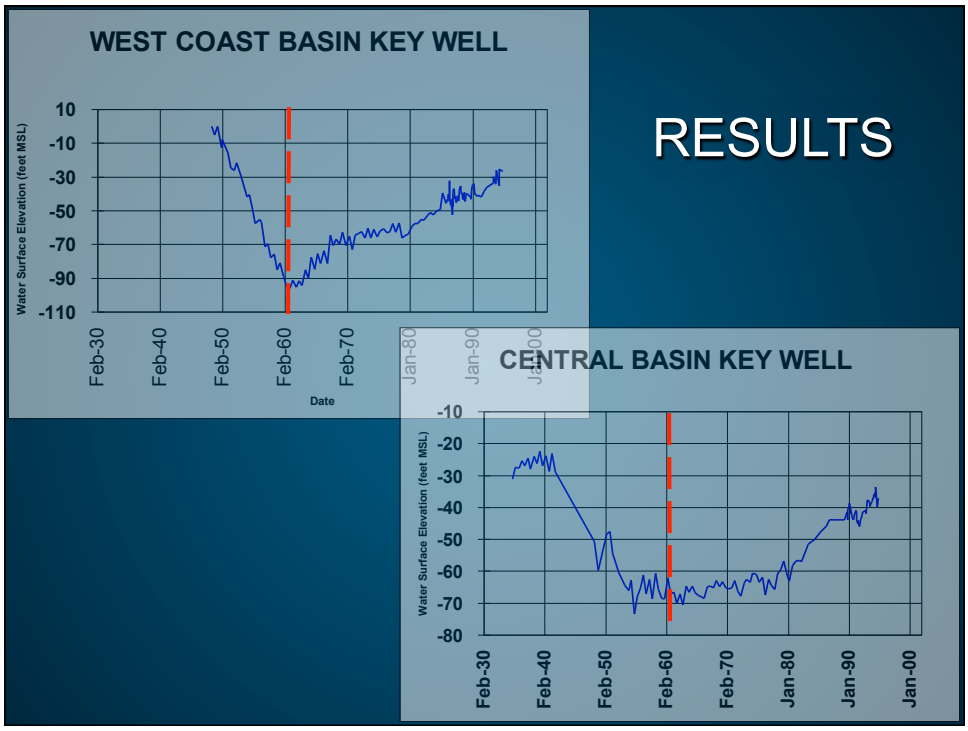


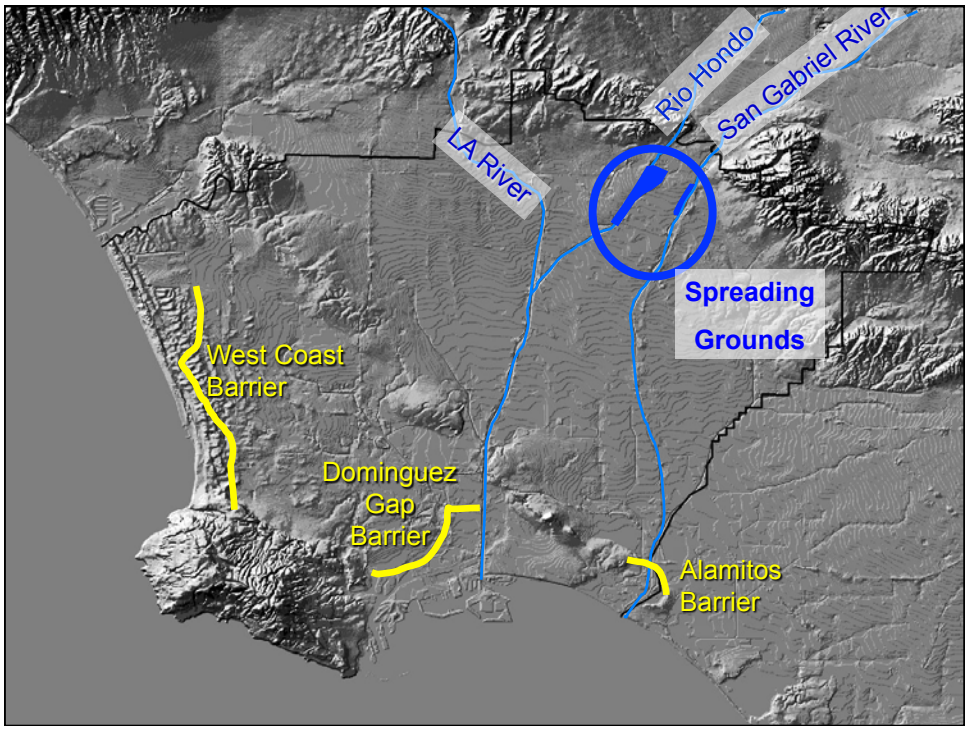
SOLUTIONS

1) *WRD formed in 1959 to provide artificial replenishment water (imported & recycled)*

2) *Adjudication of pumping in 1960s.*

3) *LA County installed barrier injection wells to halt seawater intrusion 1951 - present.*


WEST COAST BASIN KEY WELL
Water Surface Elevation (feet MSL)
10
-10
-30
-50
-70
-90
-110
Feb-30
Feb-40
Feb-50
Feb-60
Feb-70
Jan-80
Jan-90
Jan-00
Date
RESULTS
CENTRAL BASIN KEY WELL
Water Surface Elevation (feet MSL)
-10
-20
-30
-40
-50
-60
-70
-80
Feb-30
Feb-40
Feb-50
Feb-60
Feb-70
Jan-80
Jan-90
Jan-00

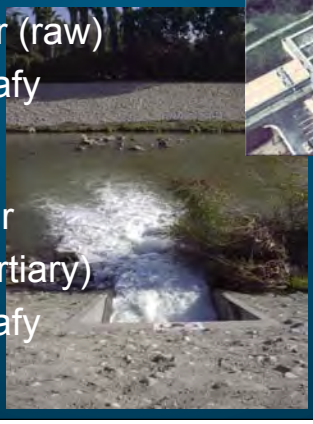

LA River
Rio Hondo
San Gabriel River
Spreading Grounds
West Coast Barrier
Dominguez Gap Barrier
Alamitos Barrier

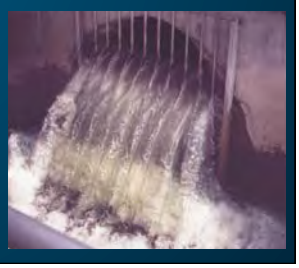
Rio Hondo spreading grounds

San Gabriel spreading grounds

Spreading Water Sources

- Local Water (storm water & base flow)
  avg ~ 50,000 afy
  free
- Imported Water (raw)
  avg ~ 25,000 afy
  $270/af
- Recycled Water (disinfected tertiary)
  avg ~ 50,000 afy
  $21/af



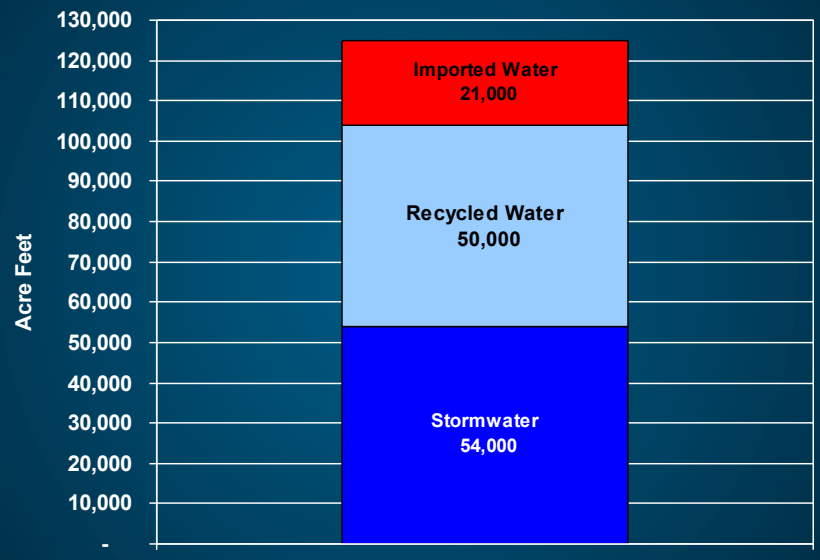


Barrier Water Sources

- Imported Water (potable)
  $430/af - $528/af

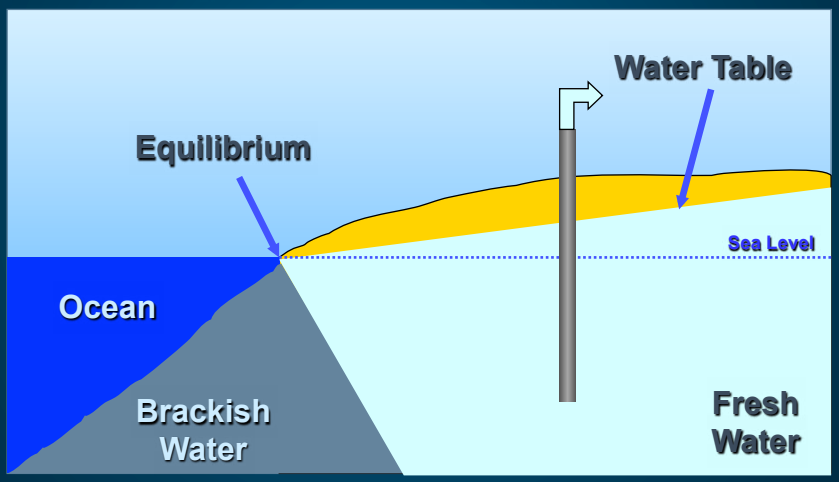
- Recycled Water (tertiary+MF+RO+UV)
  $287/af - $430/af
  Cost includes subsidies from MWD and Federal funds/ grants

Central Basin Replenishment Sources



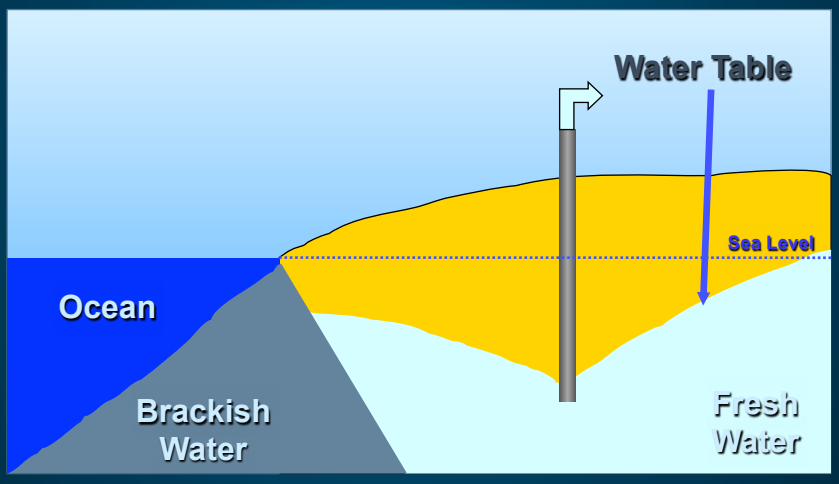
Seawater Intrusion

Coastal Aquifer - No Pumping



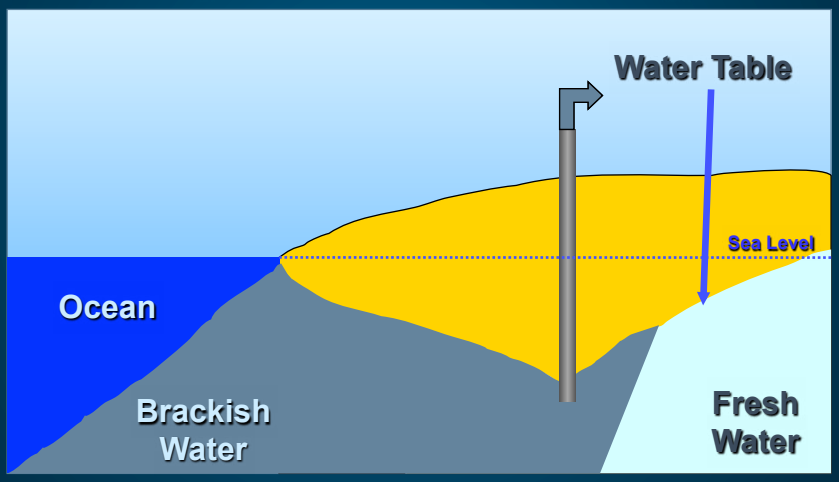
Seawater Intrusion

Coastal Aquifer - With Pumping



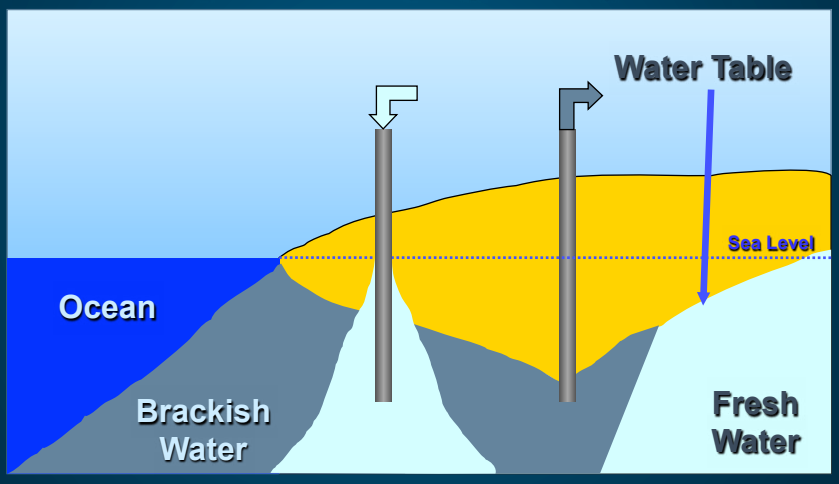
Seawater Intrusion

Coastal Aquifer - Intrusion Advancing



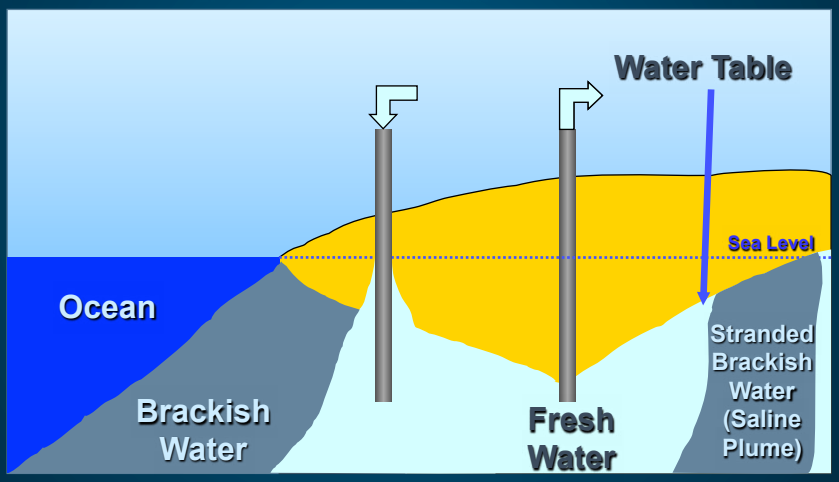
Seawater Intrusion

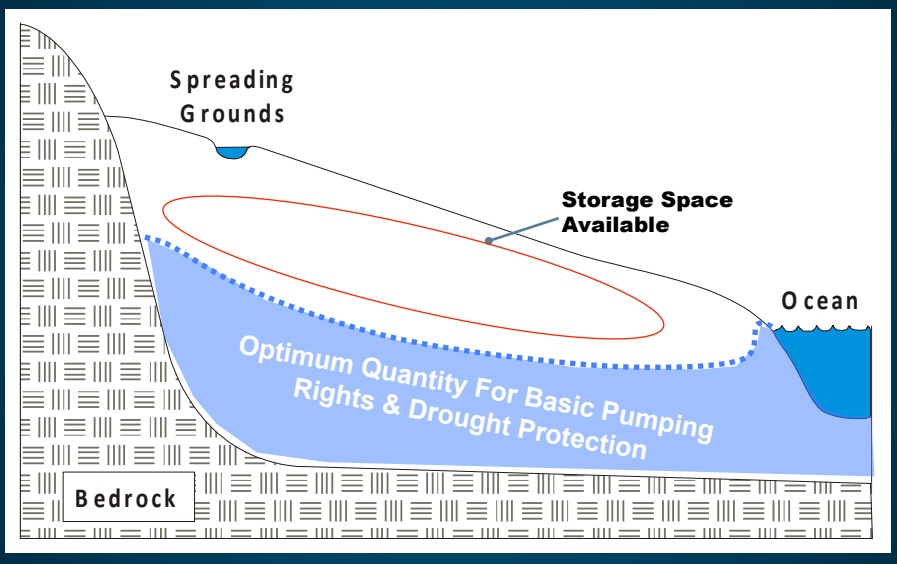
Coastal Aquifer - Pumping and Injection



Seawater Intrusion

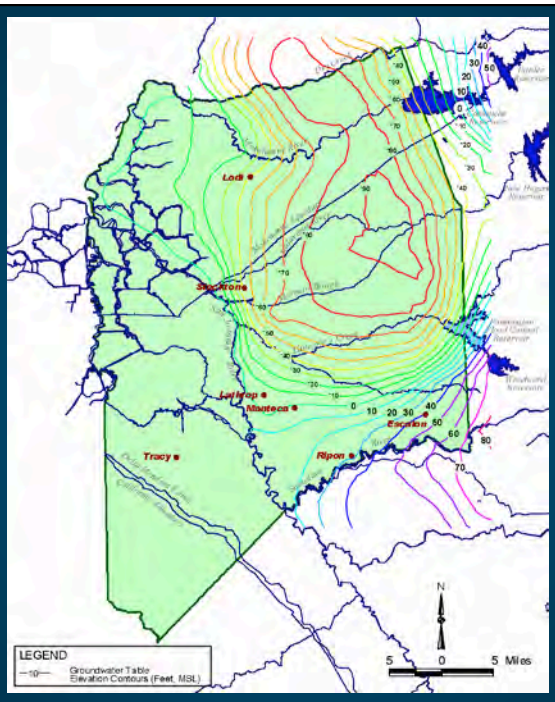
Coastal Aquifer - Pumping and Injection





City and County Powers

- Comprehensive or general plans
- Police power regulation; management through groundwater ordinance
- Coordination with AB3030/SB1938 Plans
- Many counties have ordinances to prohibit groundwater exports
- San Joaquin County example



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Coordinated Agreements

- Can provide for development of groundwater basin model, joint capital projects and joint operational policies
- Unanimous agreement between parties
- Potentially time consuming and cumbersome
- May not involve all stakeholders
- Sacramento Regional example

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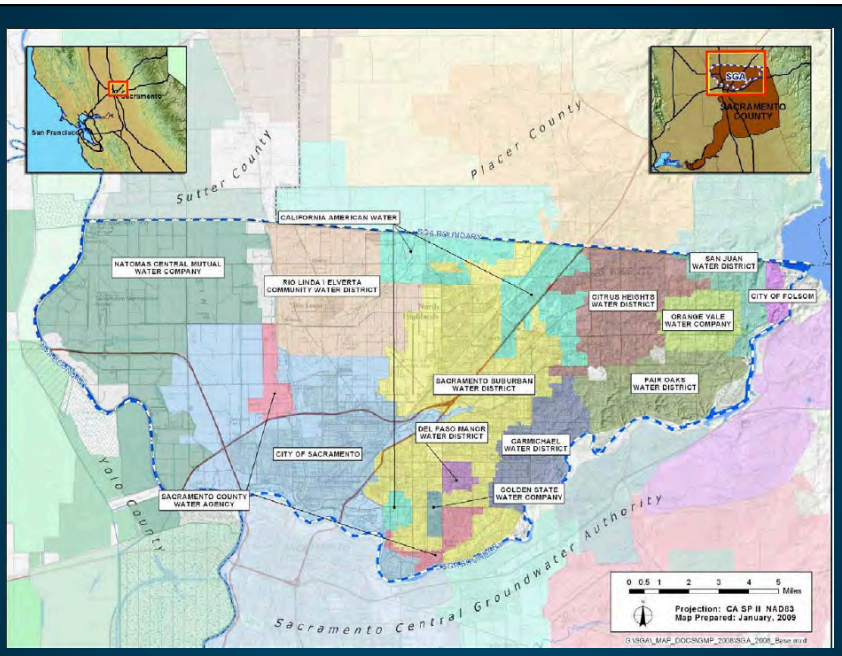
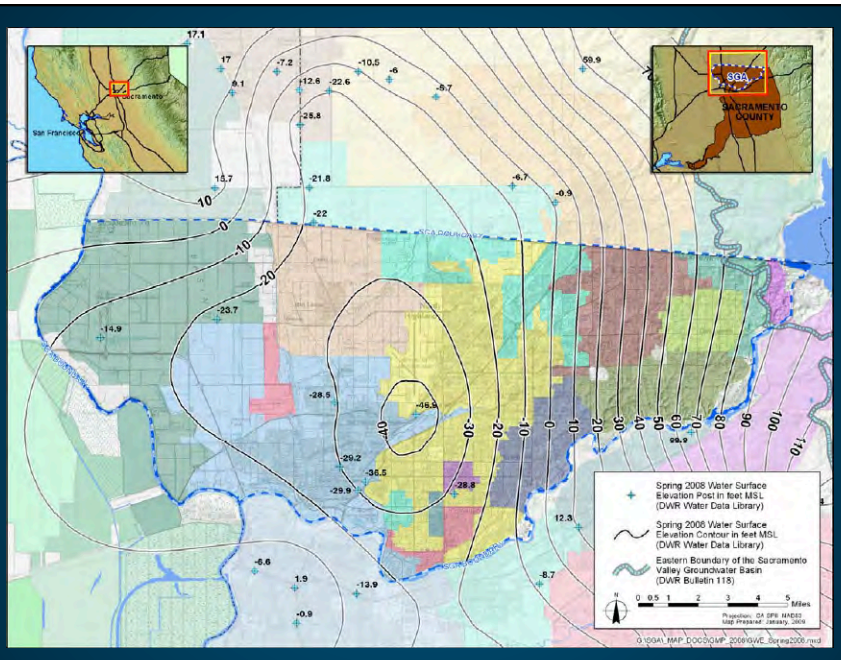


3/8/12 31



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Adjudication and Physical Solution

- Lawsuit is filed
- Stakeholders hire technical consultants and attorneys
- Seek a physical solution which determines the safe yield of the basin and individual pumping rights
- A judge decides on final determination, dictates pumping rights, and appoints a Watermaster (DWR)
- All pumpers are required to report annual pumpage to the court-appointed Watermaster
- Any proposed changes or adaptations to changing hydrology have to go back through the courts
- West Coast and Central Basins

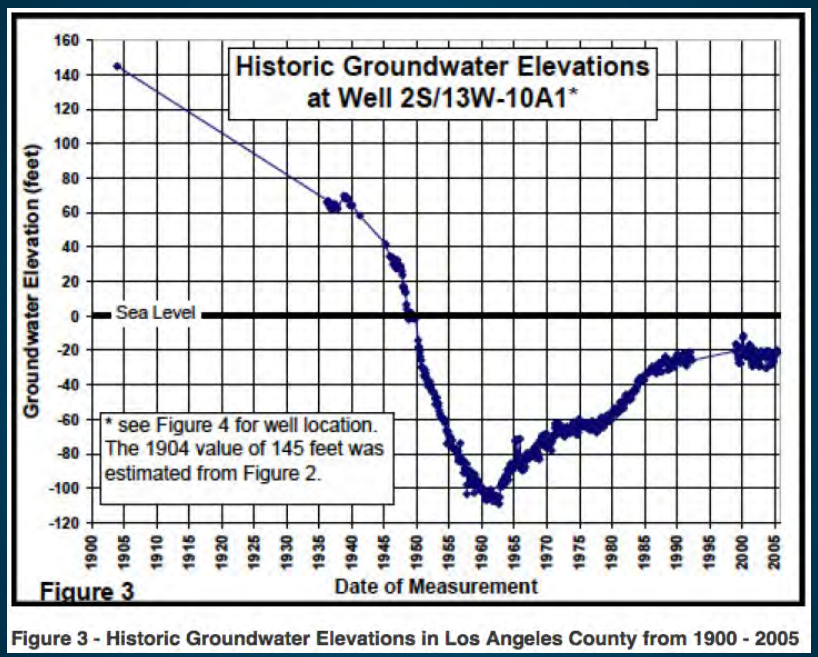

Figure 3 - Historic Groundwater Elevations in Los Angeles County from 1900 - 2005

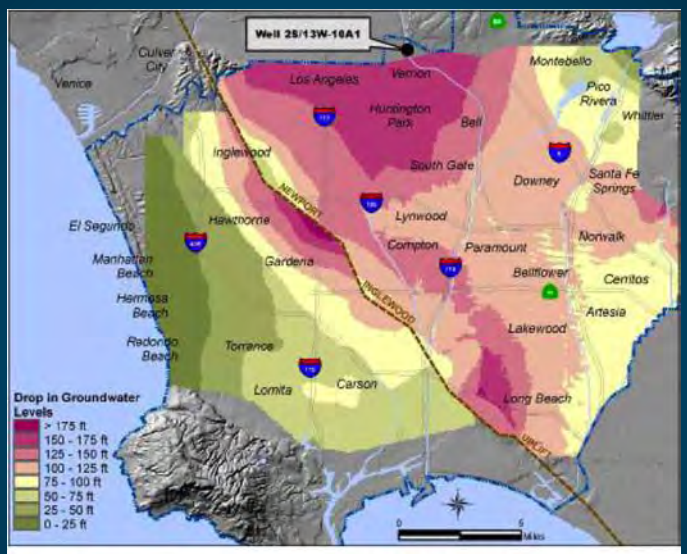

Figure 4 - Drop in Groundwater Elevations in Los Angeles County from 1904 to 2004

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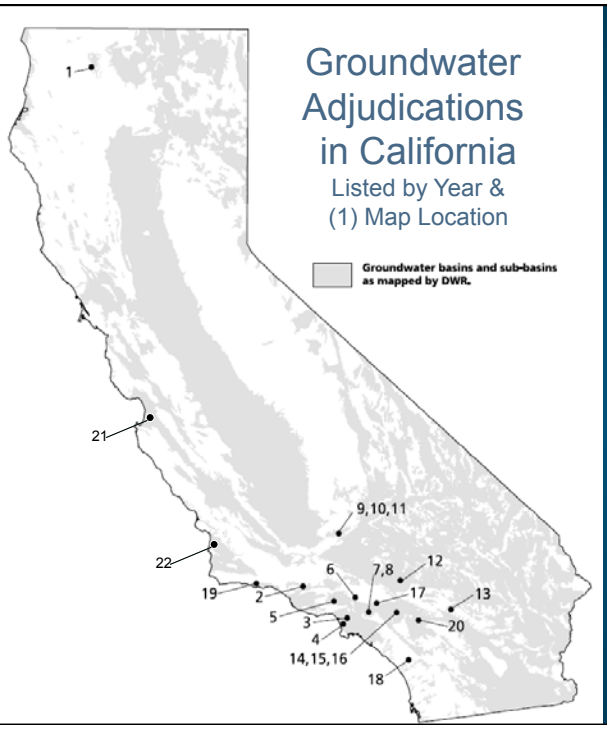
450,000 acre feet of groundwater storage space available in basins



1944 Raymond Basin (6)
1961West Coast (4)
1965 Central Basin (3)
1966 Santa Margarita (18)
1970 Brite Basin (11)
1972 Cummings Basin (9)
1973 Tehachapi Basin (10)
1973 Main San Gabriel (7)
1977 Warren Valley (13)
1978 Chino Basin (14)
1979 Upper LA River (5)
1980 Scott River (1)
1985 Puente Basin (8)
1989 Goleta (19)
1996 Santa Paula (2)
1996 Mojave Basin (12)
1996 Cucamonga Basin (15)
1996 San Bernardino (16)
1998 Six Basins (17)
2004 Beaumont (20)
2006 Seaside (21)
2008 Santa Maria (22)

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Groundwater Management Act AB3030/SB1938

- Local agency groundwater management
- May exercise powers of a replenishment district
- Provides for agreements between public and private parties
- Permissive legislation and voluntary cooperation
- Approximately 150 GMPs statewide

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Successful Groundwater Programs

- Legal authority - governance
- Involvement and cooperation of overlying landowners – basin advisory panel and public outreach program
- Benefit all basin groundwater users
- Provide a sustainable water supply
- Optimize water use thru landscape ordinances, conservation, recycling, & conjunctive use

What is Groundwater Management?

- Water resources setting understanding
- Stakeholders
  - Define basin management objectives
  - Management components to meet objectives
  - Develop implementation schedule and budget

Bulletin 118-2003, Appendix C

http://www.groundwater.water.ca.gov/bulletin 118/update2003/index.cfm

GMP – Required Elements
(for funding eligibility)

- Basin management objectives and components relating to the monitoring and management of:
  - Groundwater levels
  - Groundwater quality degradation
  - Inelastic land surface subsidence
  - Changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin
- Recharge area mapping (2013)

GMP – Required Elements
(for funding eligibility)

- Map that details the area of the groundwater basin and plan area (boundary)
  - Area of the local agency that will be subject to plan
  - Boundaries of other local agencies that overlie the basin in which the agency is developing a groundwater management plan
- Plan to involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin

GMP – Required Elements
(for funding eligibility)

- Adopt monitoring protocols to detect changes in
  - Groundwater levels
  - Groundwater quality
  - Inelastic surface subsidence for basins
    - For which subsidence has been identified as a potential problem
  - Flow and quality of surface water
    - That directly affect groundwater levels or quality or are caused by groundwater pumping in the basin
  - Designed to generate information that promotes efficient and effective groundwater management

GMP – Optional Elements

1. Control saline intrusion
2. Recharge/wellhead protection areas
3. Contaminated groundwater migration control
4. Address abandonment wells
5. Replenish groundwater
6. Monitor groundwater levels and storage
7. Mitigate overdraft
8. Facilitate conjunctive use
9. Well construction policies
10. Groundwater capitol projects – build, O&M
11. State/federal regulatory agencies relationships
12. Coordinate land use planning for groundwater protection

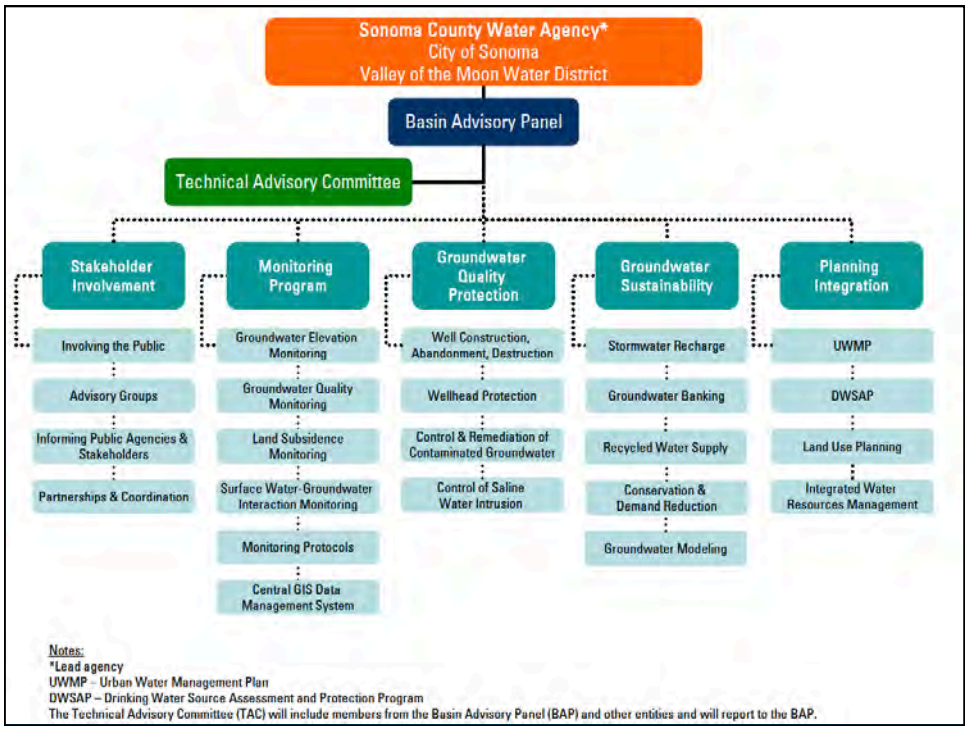
GMP - Outline

- Introduction and purpose
- Water resources setting
- Mission and basin management objectives
- Plan components
- Plan implementation
- References
- Appendices

Table 2: Options for Groundwater Management Plan Legal Frameworks

Management Option	Local Stakeholder Interests						Description
	Local Control	Non-Regulatory	Voluntary	Stakeholder Driven	Enhance Funding Opportunity	Cost to Dev. & Implement	• Requirements • Who Decides • Role of Individuals
AB 3030	Yes	Non-Reg	Yes	Yes	Yes	$ - $$	• Public agency that provides water service or joint powers authority & certain plan components • Decisions in hands of lead agency or collaborative entity • Individuals can remain active in collaborative decision-making group
Special/ General Act Districts	Yes	Reg	No	No	Possible	$ - $$	• Act of the State Legislature • District Board of Directors makes the decision and can enact ordinances to regulate groundwater pumping • Attendance at public hearings
City & County Powers	Yes	Reg	No	No	Possible	$ - $$	• City and counties regulate real property through zoning and police power of the state in an effort to promote the health, safety and welfare of citizens; typical activities include coordination of water supply and land development, protection of natural resources and elimination of public nuisances • City Council and County Board of Supervisors • Attendance at public hearings
Coordinated Agreements	Yes	Reg	No	No	Possible	$ - $$	• Public agency(s) that provides water service • District Board of Directors makes decisions • Attendance at public hearings
Water Replenishment Districts	Yes	Reg	No	No	Possible	$ - $$	• Act of the State Legislature • District Board of Directors makes decisions and can levy assessments for groundwater replenishment • Attendance at public hearings
Adjudication	No	Reg	No	No	Possible	$$$	• Occurs as a result of a lawsuit • The court judge decides pumpage based on the physical solution and case hearings, and court appoints a Watermaster (DWR) who enforces the judgment; court also makes any future changes to the pumpage or solution • Hire attorneys & experts to defend rights; report pumpage & water levels to DWR


Sonoma Valley
Groundwater
Management Program
3/8/12
Slide No. 47


Sonoma County Water Agency*
City of Sonoma
Valley of the Moon Water District
Basin Advisory Panel
Technical Advisory Committee
Stakeholder Involvement
Involving the Public
Advisory Groups
Informing Public Agencies & Stakeholders
Partnerships & Coordination
Monitoring Program
Groundwater Elevation Monitoring
Groundwater Quality Monitoring
Land Subsidence Monitoring
Surface Water-Groundwater Interaction Monitoring
Monitoring Protocols
Central GIS Data Management System
Groundwater Quality Protection
Well Construction, Abandonment, Destruction
Wellhead Protection
Control & Remediation of Contaminated Groundwater
Control of Saline Water Intrusion
Groundwater Sustainability
Stormwater Recharge
Groundwater Banking
Recycled Water Supply
Conservation & Demand Reduction
Groundwater Modeling
Planning Integration
UWMP
DWSAP
Land Use Planning
Integrated Water Resources Management
Notes:
*Lead agency
UWMP – Urban Water Management Plan
DWSAP – Drinking Water Source Assessment and Protection Program
The Technical Advisory Committee (TAC) will include members from the Basin Advisory Panel (BAP) and other entities and will report to the BAP.